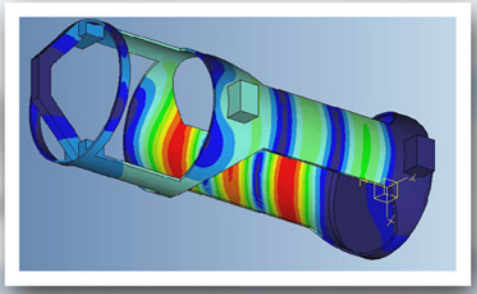
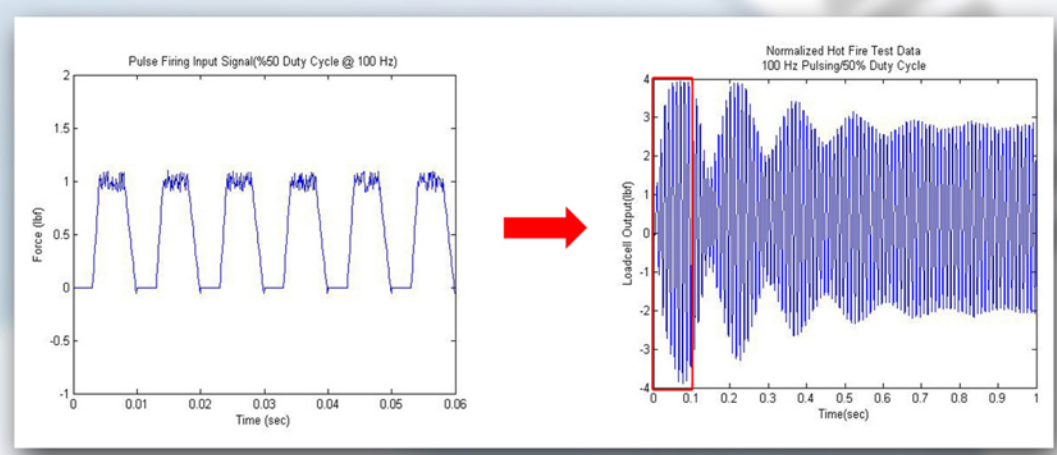
Innovation @ WSTF 2011

Mobile Modal Testing Unit (MMTU)



Finite Element Analysis (FEA) Results Indicating a Low Frequency Response Mode of TS-406 Thrust Measurement System's Cylindrical Component

Mobile Modal Test Unit Conceptual Schematic



Desired Thrust Measurement

Actual Thrust Measurement Data

Issue

Many test programs are interested in testing rocket engines with pulsing mission duty cycles. White Sands Test Facility (WSTF) instrumentation and thrust stands are designed to only accommodate static hot fires.

Subjecting a design developed for relatively static operations to significant periodic dynamic loading results in unacceptable data quality and possibly structural failure.

Overexcitation of the thrust stand will increase the magnitude of displacement, resulting in increased internal stresses and strains.

Solution

Determine and record the dynamic characteristics of WSTF's thrust stands to provide clear constraints on dynamic testing to customers interested in pulsed propulsion system testing

Objectives

- Develop a modal testing system that can be used to determine the dynamic characteristics of WSTF'S thrust stands and other critical structures
- Reduce system development expenditures and promote education by working in conjunction with University of Texas at El Paso (UTEP)

Deliverables

- Portable modal testing system
- WSTF Standard Instruction (WSI)/Handbook that outlines how to obtain the data
- Database with the following information for five most energetic modes with frequencies lower than 400 Hz for each thrust stand:
  - Range of pulsing frequencies
  - Mode frequencies
  - Mode damping
  - Mode shapes